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EDITORIAL

Steam cylinder lubrication constitutes one of the most important phases of the work of the lubrication engineer. The article published in this months issue on the subject was written by an engineer who is constantly in touch with the actual conditions in the power plant, and his treatment of the subject is practical as well as scientific. The facts presented in Mr. Wilson's paper constitute an expression of the general policy of the technical experts of The Texas Company. In connection with this article we should like to emphasize two facts: first, that the complete line of Texaco cylinder oils has been practically demonstrated under all classes of operation by a corps of efficient lubrication engineers, and second, that the Company maintains throughout this and other countries engineers whose business it is to advise consumers as to the most efficient use of Texaco lubricants, and whose services are at their disposal.

The first requisite for efficient lubrication is the proper selection of the lubricants, but second in importance to proper selection is their proper application. The article by Mr. Edwin M. May on "Modern Apparatus for the Scientific Lubrication of Machinery" not only deals with various phases of this problem but also is an evidence of the close co-operation that exists between the manufacturers of apparatus for the application of lubricants and the progressive manufacturers of the lubricants themselves.

On a number of occasions "Lubrication" has called attention to the wonderful strides which have taken place recently in the development of Diesel engines. We are, of course, particularly interested in this question because of the fact that we have a lubricant—TEXACO Ursa Oil—which is preeminently adapted to the lubrication of all types of Diesel engines; so much so, in fact, that practically all manufacturers of Diesel engines recommend the use of TEXACO Ursa Oil. The Diesel engines in the U. S. S. "Maumee" are of special interest in that they are probably the largest Diesel engines that have ever been constructed for marine use.

STEAM CYLINDER LUBRICATION *

By H. J. Wilson

Lubrication Engineer, The Texas Company, Philadelphia

IN the lubrication of the internal wearing surfaces of the valves and cylinders of steam engines, conditions are met which are altogether different from those encountered in external lubrication. In the case of journals and bearings, oil can be applied directly to the surfaces to be lubricated. In steam cylinder lubrication, however, the flow of steam is generally depended upon to convey the oil to the parts or wearing surfaces requiring lubrication. Some of the factors that influence internal lubrication are the conditions of the surfaces, the steam pressure, the nature of the steam, the piston speed, the weight and fit of the moving parts, and the make or type of the engine.

Boiler and Steam Conditions—From the standpoint of lubrication, the quality of steam taken from the boiler, whether wet, dry, or superheated, is the point of chief interest in connection with the boiler room. The condition of the steam is governed to an extent by the design of the boiler. Steam is always taken from the highest part of the boiler above the water line with the object of obtaining steam of a dry nature. Owing to the small amount of steam space in certain types of boilers, when they are forced or are subjected to excessive use of boiler compounds or to the introduction of vegetable or animal oils with boiler feed water, a violent ebullition of the water takes place, carrying a large percentage of water over with the steam into the steam header, and with inadequate separating devices on the steam lines, the water is carried into the engine cylinders. In order to overcome this condition the majority of boilers on the market today are equipped with one of the three following devices: the dry pipe, the steam dome, or the superheater.

The dry pipe is placed inside of the boiler close to the top of the boiler shell. It is rigidly fastened, and extends approximately one-fourth of the length of the boiler. It is provided with numerous slots or openings through which the steam passes as it leaves the boiler, the total area of the openings in the dry pipe being usually seven-eighths of the area of the steam connection leading from the boiler. As the pressure in the dry pipe, when steam is passing through, is less than that in the boiler, the tendency is to dry the steam in the pipe. Another method of securing dry steam from a boiler and increasing the steam space is by means of a vertical dome, which constitutes a part of the boiler.

Steam that has a higher temperature than that corresponding to its pressure is termed superheated. In other words, steam is said to be superheated when at any given boiler pressure it has a higher temperature than the water from which it was evaporated. Moisture, no matter from what cause arising, cannot exist in superheated steam, as it robs the steam of its extra heat and is itself converted into steam.

The temperature of saturated steam cannot be raised without in-

* From a paper read at the Third Annual Meeting of the Lubrication Engineers of The Texas Company, held in New York, October 11 to 14 inclusive.

creasing its pressure, but by passing the steam through a superheater which consists of a series of tubes that are either placed in the path of the hot gases leaving the boiler or a separately fired superheater, the steam expands and at the same time all moisture is evaporated into steam by the additional heat without the pressure being increased.

The necessity of purifying boiler feed water has led to the introduction of innumerable chemical compounds, sold under various names, for the prevention or removal of scale from boilers. These compounds usually contain lime or soda, or a mixture of both, but soda forms the basis of most such compounds. Excessive use of boiler compounds tends to increase foaming and priming in boilers; and the water, containing a large percentage of boiler scale, consisting of lime, magnesia, silica, and other substances, accumulates in the steam chest and cylinders. These compounds saponify the oil adhering to the cylinder walls and wash it off, leaving the surfaces dry, greatly increasing the friction of the piston and valves, and subjecting the valves and cylinder walls to corrosion when left standing.

The steam header, carrying the steam from the boiler to the engine, should always be considered by the lubrication engineer, as it is quite often the case that steam will be obtained from the boiler in a comparatively dry state, but after it has passed through the long steam header, which is often poorly covered and subjected to low temperatures, its temperature has dropped considerably, due to the loss of heat by radiation. The percentage of moisture contained in the steam increases in proportion to the decrease in temperature.

The method employed to remove condensation from the steam header should be carefully observed. Condensation is removed by means of separators, which consist of a receptacle placed in the steam line through which the steam passes before entering the cylinder. Separation is accomplished by means of a baffle plate extending from the top approximately two-thirds the length of the separator. The steam, striking the baffle plate, throws off the condensation, which falls to the bottom of the separator, the steam leaving the top on the opposite side of the baffle plate. Condensation is removed from separators by means of steam traps, or by the Holly return system. Some steam users depend entirely on steam traps that are provided at various points along the steam header.

The Holly return system is operated in the following manner: The steam header, which is placed higher than the boilers, drains all condensation into a receiving tank placed at the lowest obtainable point lower than the piping to be drained. The condensation drains into the receiver and returns to the boilers through a pipe provided for this purpose. This result is brought about owing to the difference in height between the boiler and steam header. Without the aid of any mechanical arrangements, however, steam traps and Holly systems are not efficient unless used in conjunction with separators.

Lubricators—After taking all steam and boiler conditions into consideration, the next matter of importance is the lubricator. While lubricators are made in numerous types, their working principles differ but little, and can be classified as hydrostatic and mechanical. In the hydrostatic lubricator it is the difference in pressure existing in the lubricator, due to the weight of

water that has condensed in the condensing chamber above the oil chamber, that forces the oil through the sight glass and feed pipe into the steam header. The mechanical lubricator consists of a force feed pump usually direct-connected to the valve rod of the engine, which forces the oil through check valves into the steam header. The use of the mechanical lubricator has many advantages on units that have intermittent operation. As the oil is only fed while necessary, it is more positive and reliable than the hydrostatic lubricator, a more uniform feed being maintained. However, mechanical lubricators are not adapted to low surrounding temperatures unless provided with heating coils, as the cylinder oil, solidifying in the reservoir, will not flow to the pump. Certain types of mechanical lubricators are not suitable for compound condensing engines operating on a light load, unless the check valves on the discharge side of the pump are spring loaded, as a vacuum acting on the oil pipe with atmospheric pressure on the reservoir will syphon the oil from the reservoir.

Lubrication—To obtain efficient lubrication in a steam cylinder it is necessary to effect atomization of the oil before it enters the steam chest and cylinders. This is accomplished by connecting the feed pipe from the lubricator to the steam header at a point such that atomization would not be affected by a steam separator or angles in the pipe between the point of introduction and the steam chest, allowing the oil feed pipe to extend into the center of the steam header. By so doing, the cylinder oil, coming in direct contact with the column of steam at the point of greatest velocity, is broken into small particles, carried along with the steam, and sprayed in a homogeneous state over the entire surface to be lubricated. However, there are a large number of engines on the market having the lubricator feed pipe connected directly to the steam chest, and, when possible, lubricator feed lines should be changed to steam lines as suggested above.

When selecting the lubricant for a steam cylinder, the position of the lubricator feed pipe is very important. With the lubricator feed pipe connected to the steam header at a distance of six feet or more above the steam chest, an unfiltered compound cylinder stock high in viscosity, such as Texaco Zenith Valve Oil, can be used to good advantage, as there is sufficient space between the lubricator feed pipe and the steam chest for the oil to atomize and enter the steam chest in the form of spray. With the lubricator feed pipe connected directly to the steam chest, a filtered or semi-filtered cylinder oil such as Texaco Regal Cylinder Oil or Texaco Olympian Cylinder Oil, will prove more efficient, as cylinder oils of this nature will atomize more quickly when forced directly into the steam chest.

A cylinder oil should be selected of sufficient viscosity or body to withstand the pressure exerted by the piston at operating temperatures. In the case of saturated steam it should also be compounded with a percentage of the proper animal oil to give the emulsifying quality necessary to make the oil adhere to the cylinder walls. The percentage of compounding material should vary with the amount of moisture in the steam. Owing to the high temperatures encountered when superheated steam is used, the cylinder walls are in a very dry state, and an oil containing a large

percentage of compound is unnecessary, unless it is found as a matter of fact that moisture is present in the low pressure cylinders, in which case it is highly desirable to use a larger percentage of compounding in the cylinder oil.

Types of Steam Engines—In the horizontal engine, except in the case of the tail rod engine, the entire weight of the piston must be supported by the lower portion of the cylinder barrel, and as the piston and rod must be made massive in order to have the required strength and stiffness, it becomes necessary to have a lubricant that will maintain sufficient body under operating temperatures to support the weight of the piston and rod and eliminate excessive wear on the lower section of the cylinder barrel. On this type of engine, even with the most efficient lubricant, some wear occurs, allowing the steam to leak past the piston rings.

The tail rod engine overcomes this defect by extending the piston rod through the head end of the cylinder, through a steam-tight stuffing box. The weight of the rod and piston is supported by the tail rod and shoe, thus relieving the cylinder walls. On this type of engine the steam ring tension is regulated to form a steam-tight joint.

A high pressure engine is an engine with one or more cylinders in which the full expansive force of the steam is utilized without the aid of a condenser. In a single cylinder engine high and low pressures and high and low temperatures are experienced owing to the full expansive force of the steam taking place in the single cylinder. In a four-valve engine it is often noticeable that the admission valves, piston and cylinder walls are perfectly lubricated, while the exhaust valves are improperly lubricated and groan, owing to the low temperature of the steam and to the large percentage of moisture washing the oil from the exhaust valves and seats. The low pressure cylinders utilize the exhaust steam after it has been expanded in the high pressure cylinders. The exhaust steam, after leaving the high pressure cylinders, usually exhausts into a receiver that removes a large part of the condensation from the steam before it enters the low pressure cylinders. However, there is always moisture encountered because of the low pressure and low temperature of the steam, and a compounded oil is necessary to form an emulsion on the cylinder walls.

Vertical engines employ the same method of cylinder lubrication as the horizontal types. As the piston rides in a vertical position the pressure on the cylinder walls is greatly relieved, and the tension of the steam rings is the only pressure exerted. On account of this decrease in weight they do not require the amount of cylinder oil that is necessary on a horizontal engine. The selection of cylinder oil, however, is governed by the same considerations as in the case of the horizontal engine.

Steam Pump Lubrication—While the same method of lubricating steam cylinders is employed for steam pumps as for the engine cylinders, conditions are somewhat different owing to the intermittent operation of the pumps. All elevator, boiler feed, tank, well pumps, etc., are usually controlled by an automatic regulator placed on the discharge side of the pump, by which the speed of the pump is regulated by the opening and closing of the regulating steam valve. When the pump is shut down, the condensation which takes place in

the steam line has a tendency to wash the oil from the cylinder walls when the steam valve is opened. Therefore, in steam pump cylinder lubrication a compounded cylinder oil is essential in order to withstand the large percentage of moisture.

Condensers—The exhaust steam from a high pressure engine is exhausted at or above the pressure of the atmosphere, that is, above a pressure of 14.7 pounds per square inch. Steam cannot be expanded below this pressure in a non-condensing engine, as the atmospheric pressure would have a retarding effect on the piston. Therefore, to overcome this back pressure and derive the full expansive force of the steam, condensers are used. They may be placed in the two following classes—Jet and Surface. In the first class the condensed steam and water come into direct contact. In the second class the steam is condensed by striking cool surfaces. The cooling surface is made up of pipe or tubes of brass or copper through which the cooling water circulates, the steam condensing when it comes in contact with the cool tubes. Surface condensers are usually used on sea-going vessels, and on land where the feed water is injurious to the boilers.

When a compounded cylinder oil is used in the engines, and the condensed steam is used for boiler feed, an oil separator is necessary, or else it is necessary to use a straight mineral cylinder oil like Pinnacle Mineral or Regal Mineral Cylinder Oil, as a compounded oil, if taken directly into the boiler, would have a tendency to cause foaming and would be injurious to the boiler plates. The same applies to open feed water heaters that utilize the exhaust steam to heat the feed water before entering the boiler.

Ice Plants—Owing to the difficulty experienced in obtaining a pure clear water, it is necessary to manufacture ice from artesian well water or distilled water from the boiler. If, in the first case, a closed feed water heater is employed, a compounded oil can be used with best results, since the exhaust steam from the engine does not come into direct contact with the boiler water. If the feed water heater is of the open type, in which the exhaust steam and water come into direct contact, a straight mineral oil is necessary. An oil of good quality should be selected in order to obtain efficient lubrication with a minimum amount of oil. If a compounded cylinder oil should be selected for an ice plant using distilled water, it would result in the discoloring of the ice, which would present a cloudy appearance.

Petroleum base cylinder oil has today reached the highest degree of perfection, and is without a doubt the most efficient and economical steam cylinder lubricant known. It reduces friction to a minimum, thereby preventing wear, preserving the metal case, and hardening the cylinder wall, piston, valve rods, valves, and valve seats. A proper cylinder oil keeps the cylinders clean and bright and the piston rings free and loose, allowing them to perform their work properly. The cylinder oil also finds its way out through the packing, lubricating the piston and valve rods, working out on the cylinder stud bolt, and rendering the practice of feeding cylinder oil externally to piston and valve rods unnecessary. Since it is non-corrosive it preserves the threads of the bolts as well as all metallic parts it reaches. Therefore it might be well for those who pay the bills to know that low-priced lubricants, such as grease, cheap

cylinder oils, graphite, etc., do not and cannot perform all the functions of a perfect cylinder oil. While it is true that the cost of cylinder oil may be slightly reduced by purchasing cheap lubricants and placing them in the hands of employees to use carelessly, yet the expense of developing additional power to overcome the friction is many times in excess of the saving.

There are certain difficulties which arise in connection with the operation of steam engines which are frequently laid to cylinder oil but which are in reality due to other causes. One difficulty is the knocking at the extreme end of the stroke. This is due to one of three causes: first, the piston striking the head of the cylinder, which is very often caused by continual keying up on the crank pin and wrist pin without making allowance on the piston rod for the increased length of the stroke; second, loose piston parts, consisting of loose bull ring, steam rings, follower plate, follower bolts, or loose rod unit; third, excessive compression, due to defective valve setting. If too much lap is allowed on the exhaust valves there will be a higher internal pressure in the cylinder than in the steam line, which causes the admission valves to be lifted from the seats at the end of the stroke, resulting in a knocking when the valves return to their seats. This cause can be located by opening the indicator cocks at the end of the stroke, relieving the excessive pressure.

Another complaint sometimes made is that the oil does not feed properly through the sight glass of a hydrostatic lubricator, but runs up the side of the glass and backs up in the glass. The glasses used on hydrostatic lubricators are of special manufacture, having a larger inside diameter than gauge glasses used for steam gauges. Very often an engineer will report that the cylinder oil will run up in the sight glass, and when the complaint is investigated it is found to be due to the use of a steam gauge glass having a smaller inside diameter than the oil gauge glass previously used. The size of the drop can be reduced by filing down the lip on the feed valve or soldering a fine wire to the lip, allowing the oil to follow the wire, thus overcoming the complaint. Backing up of the oil in the sight feed glass is due to lack of sufficient difference in pressure. The loss of the condensed steam through a leaking stuffing box on the gauge glasses or steam valves is very often due to the practice of some engineers of neglecting to close the valve beneath the condensing chamber when filling the lubricator. This results in the loss of the condensed steam above the condensing chamber and the overheating of the lubricator causing the gauge glass gaskets to soften and leak. The frequent practice of heating the cylinder oil by placing the oil in a receptacle on top of the steam chest is very often responsible for stopping up the hydrostatic lubricator, requiring frequent blowing out on account of the compound in the oil settling in the receptacle, due to the continual boiling of the oil.

Groaning in the steam cylinder is due to inefficient lubrication, caused by the use of an improper lubricant, by the improper distribution of the oil, by excessive condensation, or by the use of alkaline feed waters. The use of alkaline feed waters often occurs after a cylinder oil has been in use for a lengthy period in which it has given good results, due to the fact that the engineer may have resorted to the use of boiler compounds. Unfiltered cylinder

stocks with a large percentage of compounding will withstand a greater amount of alkali than the semi-filtered or highly filtered stocks. This theory has been worked out on a number of jobs where highly filtered cylinder oils have fallen down under an alkaline steam. On all complaints of this nature the writer advocates frequent blowing down of the boilers, while the excessive amount of boiler compound is being used, and an endeavor to cut down on the quantity used until a neutral feed water is obtained.

A well-lubricated cylinder should present a highly glazed appearance and should have a thin film of oil on all parts of the cylinder walls. The film at the top, bottom, and each side of the cylinder should be sufficiently thick to penetrate from three to six thicknesses of "Rizla" cigarette paper, which has a uniform thickness. The color of the glaze left on the cylinder walls should vary from a light silver to a gun metal blue, and the color of the oil deposited on the test paper should be of a light brownish hue. If of a blackish color it generally indicates that the oil is carbonizing or the surfaces are wearing excessively.

MODERN APPARATUS FOR THE SCIENTIFIC LUBRICATION OF MACHINERY

By Edwin M. May,

New York Manager, The Richardson-Phenix Co.

MANY of the readers of "Lubrication" are undoubtedly already familiar with the general methods of applying lubricants. Some of us remember how, in the old days, the cylinders of steam engines were lubricated by keeping suet or tallow in an old coffee pot on top of the steam chest, and pouring it, every now and then, through a hand operated oil cup into the cylinder. We also know how, for bearing lubrication on the old engines, grease cups and oil cups were used, which, we regret to state, are, in some cases, still in service.

The field covered by the modern lubrication engineer is so large and so much could be written on the subject that we will only attempt to cover in a general way the most important modern methods and apparatus for applying oil to machinery.

In the power plant we will first consider the types of generating units, classifying them as follows: (a) hydro-electric turbines, (b) steam turbines, (c) internal combustion engines, (d) Corliss steam engines, (e) unaflow steam engines, (f) high-speed steam engines. In the first two types there is no cylinder lubrication to consider, but in the other types the matter of lubricating the cylinders is an all-important factor.

Certain internal combustion engines, including Diesel and gas engines, whether using producer, natural or blast furnace gas, must have a mechanically operated force-feed oil pump so arranged that the oil is injected into the cylinders at

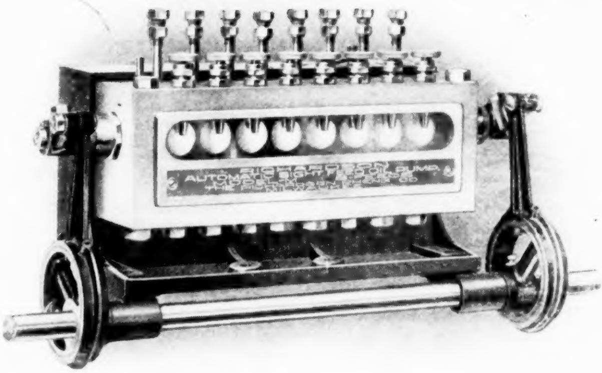


Figure 1
Eight Feed Richardson Gas Engine Cylinder Lubricator

just the proper moment. Fig. 1 shows a Richardson Model "M" gas engine lubricator such as is used by prominent manufacturers of internal combustion engines throughout the United States. By means of a divided gear shaft, each end of which operates a different set of forcing plungers, the oil is injected into the pistons between the piston rings, at the proper instant, so that it performs its functions as a lubricant before being burned up by the explosion.

With this type of lubricator, which can be equipped with any number of feeds necessary to obtain the best lubricating conditions, the oil is broken up into small particles so that a little is injected at each double stroke of the piston. In this way this type of lubricator differs essentailly from the rachet drive described later. In fact, this is the only lubricator which has successfully solved the problem of the scientific lubrication of gas engine cylinders.

A modification of the same type of force-feed oil pump is considered best adapted for use on Corliss engines, which usually operate at from 80 to 150 revolutions per minute. The eccentric drive and the divided gear shaft are done away with and a lubricator of the proper number of feeds is usually located on top of the engine cylinder. The usual practice on a Corliss engine is to have one feed go into the steampipe above the throttle and two others, one on either end of the steam chest, to lubricate the valves, with a fourth pumping the oil to the piston rod to lubricate the rod packing, though the fourth feed is not absolutely necessary. An atomizer is provided for the feed going above the throttle so that the oil is throughly broken up into minute particles before it reaches the vital parts of the throttle valve and the rubbing surfaces of the cylinder.

Attempts have been made to reclaim cylinder oil, and while there are throughout the United States several installations for this purpose which are doing fairly good work along this line, they are so comparatively crude and the expense so great that they have not come into general use. Therefore, in steam cylinder lubrication the essential feature is to inject the oil in exactly the right quantities, making these quantities as small as consistent, and pumping them into the cylinders at just the right time.

Another type of prime mover about which we hear so much these days is the unaflow engine. To lubricate this engine still another

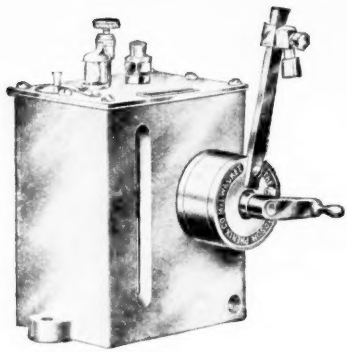


Figure 2
Single Feed Model "T"
Lubricator

modification of the RICHARDSON lubricator is used. On the types for internal combustion and Corliss engines all of the forcing plungers are operated from one side of an oscillating gear shaft which in turn is driven by a lever arm. For unaflow engine work the feeds are staggered and placed on opposite sides of the gear shaft, so that the oil is pumped first into one end and then into the other end of the cylinder at just the proper moments.

The oscillating gear shaft drive is not applicable to high-speed engines or crank-governed engines because the high speed with which a lubricator in this type of engine is operated does not permit the oil to flow by gravity under the forcing plungers, or, the source of drive is variable, and the same result obtains. Therefore, we must revert to the rachet drive lubricator, a good example of which is shown in the PHENIX model "T" oil pump, as per Figure 2. This type of oil pump will operate at any speed on any stroke and is capable of very fine adjustment. It is particularly attractive because it is so easy to fill, simple to take apart (all of the operating mechanism being attached to the cover), has no projecting moving parts, and has a heating connection. It has, of course, a sight feed, which is not under pressure and which renders every drop of oil visible before it is forced to the supply line. It is found to give most satisfactory service on high-speed crank-governed engines.

One feature which is frequently overlooked by operating and consulting engineers is the proper lubrication of the steam cylinders of auxiliaries. You will find upon investigation that it is not exceptional for the rubbing surfaces of the steam cylinders of auxiliaries to aggregate from 25 per cent. to 33⅓ per cent. of that of the main generating units, and why they do not receive more attention we are at a loss to understand. Old-fashioned, inefficient, oil-eating hydrostatic lubricators are still found attached to steam pumps, air compressors, and other auxiliaries, in a large number of supposedly up-to-date plants.

The PHENIX Model "T" lubricator, referred to above, is admirably adapted to steam pumps and auxiliaries for forcing oil into the cylinders regularly. It will pay for itself in a comparatively short time. Another method for taking care of cylinder lubrication of auxiliaries is to have one oil pump of the required number of feeds to supply all of them driven by a small steam or air cylinder or by a little ¼ h.p. electric motor. Feed lines of ⅛" may be run to the various pumps, etc., around the plant, and in this manner the necessity of having a man go around to the different units and fill each one is done away with.

In some instances where it is not desirable to use a gravity oiling system for bearing lubrication, force-feed cylinder oil pumps may

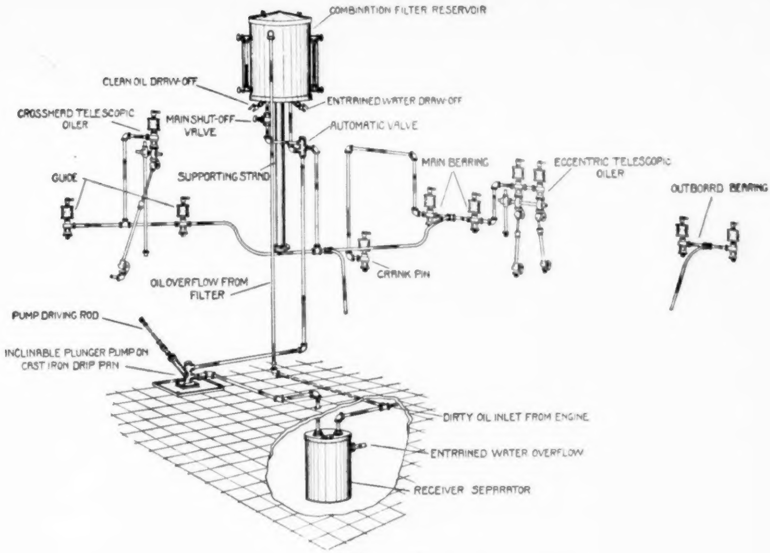


Figure 3

Phenix Individual Oiling and Filtering System

be adapted to this service. The PHENIX Model "T" rachet drive oil pump is quite extensively used for this class of work. In sugar mills particularly forced-feed lubrication to bearings is desirable, and where the crushing roll bearings are movable a coil is made in the lubricator piping so that the bearings on this movable roll may be taken care of.

For saw mills and similar types of plants a force-feed lubricating system from a central point is also quite largely used for lubricating the steam cylinders of the main engines, and for supplying cylinder oil to steam niggers, log-kickers, etc.

Every engineer is familiar with the ordinary gravity type of oiling system for bearing lubrication in the modern plant, which consists essentially of either a drain tank or filter placed below the engine room floor, so that all of the dirty oil can flow by gravity to this tank and be pumped up to either the filter or the overhead reservoir respectively. In some cases it is desirable to place the filter on the engine room floor and permit the dirty oil to flow to the drain tank and then be pumped from the filter to an overhead storage reservoir. This type of system is applicable to all styles of steam engines, gas engines, and small steam turbines, but it is not good practice to use this type on large turbines where the amount of oil circulated is so large that it would make the cost of the filter prohibitive. The different methods of filtering oil from steam turbine lubricating systems were discussed in the September, 1916, issue of "Lubrication."

Gravity oiling systems may be divided into two classes—central or group systems, and individual systems. In the former, one central filter with possibly a spare duplicate, one duplicate set of pumps, and one overhead storage reservoir, are used,

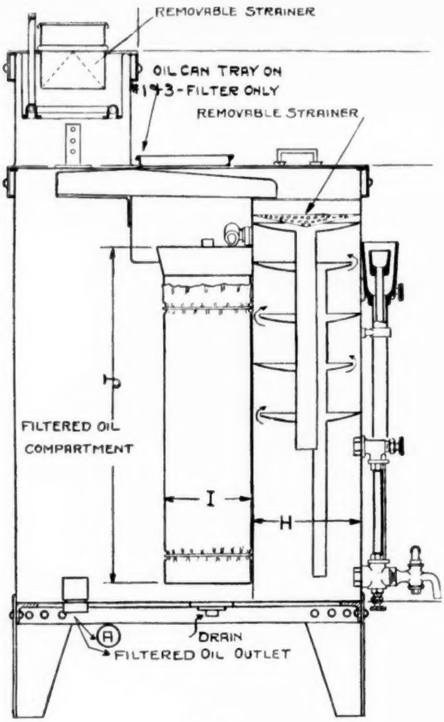


Figure 4
Richardson Filter

while in the latter, each system has its own filter, pump, and reservoir.

On simple engines up to 250 h.p. the PHENIX Individual Oiling System shown in Fig. 3 is so arranged that the filter also acts as a reservoir, and it is placed on the engine frame. Where the engine is of larger size and consequently a filter is needed of too great capacity to be placed on the engine frame, a RICHARDSON Individual System may be employed. In this system the filter is placed on the engine room floor and an overflow stand with a glass tank is arranged just high enough to have the same effect as an overhead storage tank of the same height,—the tank of course being vented.

In oil filtering systems the vital part is the filter and it is absolutely necessary to have one which is simple in operation and easy to clean, as well as one which will clarify the oil in a satisfactory manner. For small systems the RICHARDSON type of filter as shown in Figure 4 is recommended for use. These filters are designed in capacity ranging from one to thirty-five gallons hourly and employ what is known as the dry method of filtration, that is, the oil does not come in contact with the water. They have, of course, a precipitation compartment in which the heavier particles of dirt are permitted to fall by gravity to the bottom of this compartment, and from which the entrained water is automatically ejected. From this

compartment the oil overflows into the filtering cylinders which are covered with filter cloths of the proper material and thickness to meet the existing conditions.

When a filter of large capacity is required the PETERSON filter as described in the September issue of "Lubrication" is used. This is the latest and most improved type of PETERSON filter, and is so scientifically designed that it affords 600 percent. greater filtering capacity in the same space than any other type. This type of filter also employs the dry method of filtration, has a very large sediment or precipitation capacity, and instead of filtering cylinders, filtering units as shown in Figure 5 are used. This unit is a submerged type of filter and is so designed that the filtration takes place when the oil passes from the outside to the inside of the cloth. The only way the clean oil can overflow is through the nozzle leading into the clean oil compartment, and no filtration takes place until a slight head is built up on the dirty oil side, above this clean oil overflow.

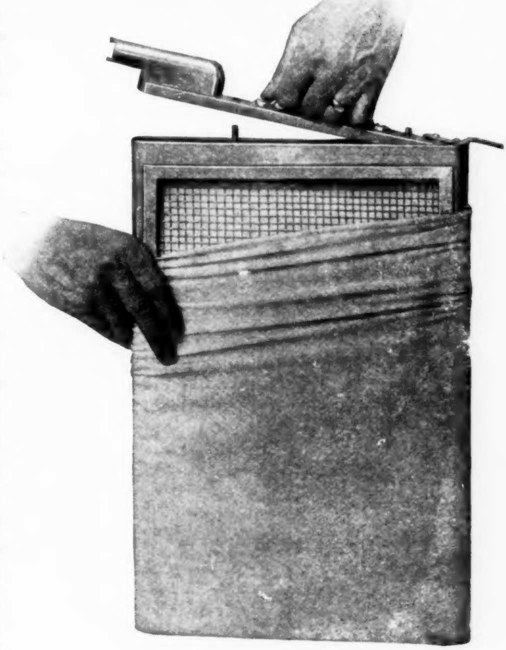
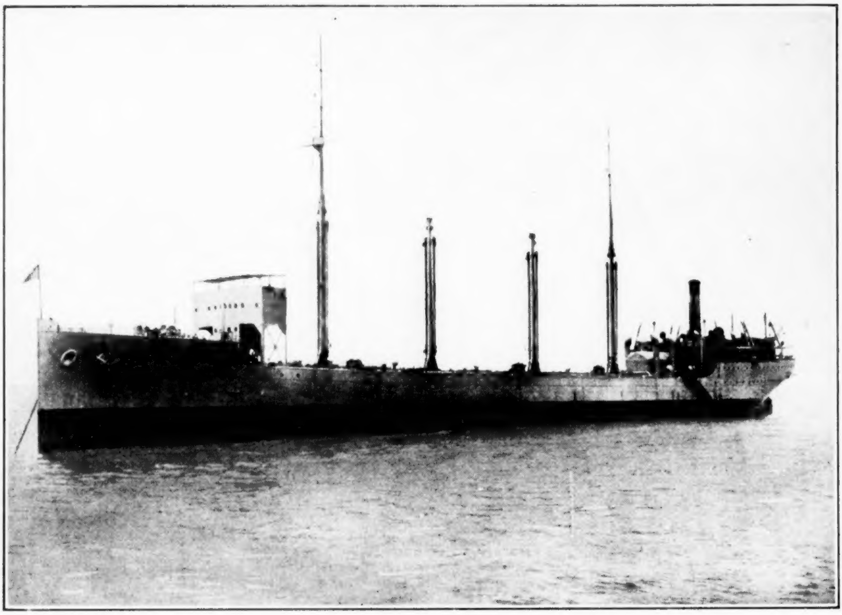


Figure 5
Peterson Filtering Unit

TEXACO URSA OIL ON THE DIESEL ENGINES OF THE U. S. S. "MAUMEE"

ON November 6, 1916, a demonstration of the operation of the Diesel oil engines of the fuel oil supply ship, "U. S. S. Maumee," was given at the Navy Yard, New York, N. Y. This demonstration was made just before the ship was put into commission, for the purpose of giving a practical exhibition of the performance of the highest powered Marine Diesel Engines installed on any vessel. On their successful operation will depend important developments in Marine Engineering in this country.

The original designs for the "Maumee's" engines were secured from Machinen Fabrik Augsberg-Nurnberg, Germany, through the New London Shipbuilding and Engine Co., New London, Conn. The engines were built by the Machinery Division, Navy Yard, New York, under the immediate supervision of Lieutenant C. W. Nimitz, of the U. S. Navy. They are six-cylinder,



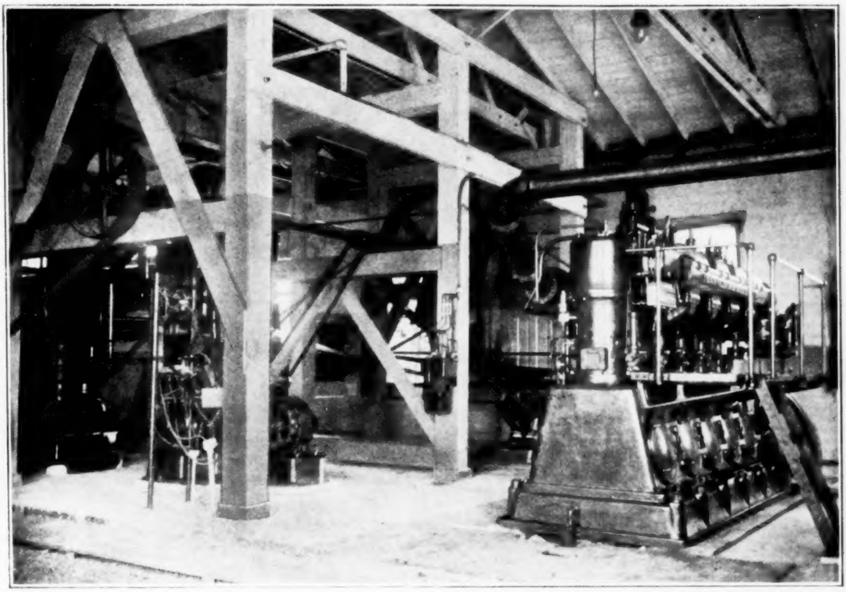
U. S. S. "MAUMEE"
Displacement 14,500 tons; Speed Designed, 14 knots; Oil Carrying Capacity, 8,000 tons.

two-cycle single acting Diesel engines of 2,600 S.H.P. (shaft horse power) each; the diameter of each cylinder is 25.2″, the stroke 37.37″, and the revolutions per minute 130. At the demonstration each engine indicated 3,170 h.p., about twenty percent. above their rated h.p.

They were first erected on heavy concrete foundations in the shop, and direct connected to large dynamos, loaded down by means of a wet resistance to get the desired load, and then run for several weeks so as to develop any defects that might exist. They were then dismantled and re-erected in the ship, given a severe series of dock trials, after which the ship went to sea for her sea trials. The bed plates are 43 feet long and 14 feet wide, and it is 25 feet from the bed plate to the top of the cylinders.

In the Navy, when there is so much at stake, naval engineers are very particular as to what lubricants they will use. The fact that from the very first the only oil that was considered and that has been used on the entire engine installation for this ship was TEXACO Ursa Oil speaks wonders for its action as a high grade Diesel Engine lubricant.

It required 50 barrels of Ursa Oil to fill the main oiling system, which supplied the twelve combustion cylinders, the six three-stage air compressors, the auxiliary air compressor, the two main thrust bearings, and all the crank pins, main shaft and other bearings of these two great engines. During the various trials there has not been a minutes delay or trouble attributable to the oil. Tests of this kind prove the claim that TEXACO Ursa Oil is the finest Diesel engine lubricant ever made.



RAW WATER FREEZING PLANT

THIS plant is of special interest as it is a type of plant practically new in the South. The equipment includes one 120-h.p. Busch-Sulzer Diesel engine, one 40-ton ammonia compression system equipped with a York Ice Machine, and a 25-ton raw water freezing system, together with an air compression and a de-humidifying plant.

The plant has been in operation for two years, and the Diesel engine has been lubricated with TEXACO Ursa Oil from the time it started up. The engineer of the plant states that it has only been necessary to make one adjustment on the bearings since the engine has been in operation and that he does not know any oil as good as Ursa for this type of engine.

CRATER COMPOUND

Houston, Texas, Oct. 10, 1916.

SUBJECT: *Crater Compound.*

MR. W. F. PARISH,
17 Battery Place,
New York City.

Dear Sir:—In the course of encouraging our field people to use Crater Compound, one of our progressive drillers had an unusual experience. On the bottom joint of our drill pipe there is used what is called a drill collar, being a solid forged piece of steel eighteen inches long. threaded inside at both ends; the top thread to receive the thread of the drill pipe, the bottom thread to receive the thread on the shank of the bit. The bit proper is fashioned very much on the order of the tail of a fish, and this collar and bit are very expensive, the operating expense being further increased by the fact that the deeper into the ground you drill the greater is the pressure put on these two bottom threads. When the bit becomes dull the pipe is removed from the well and a new bit placed thereon.

Many, many times one or both of the threads mentioned above would freeze

fast so that it was utterly impossible to remove the bit from the drill collar or the pipe, the result being that we would have to discard material that had a commercial value of from thirty to fifty dollars, and in a great many cases it was a total loss. With the above facts before you we quote below Driller Luck's original report:

"We have been constantly having trouble as to bits sticking in drill collars, and, in fact, have had to cut a number of them out with clevers and cold chisels, with the consequent ruination of the thread on the shank of the bits and in the drill collars. We have been using Vega Axle Grease mixed with graphite as a lubricant, but it seems as if the acid, sulphur, and other tainted waters would stick to the bits, and if sufficient power was used to break them, they would burn and shear all the threads off. We are now using Texaco Crater Compound, and have absolutely overcome the above mentioned trouble. I also find that Crater Compound is the best product for lubricating and preserving drilling cables. It is indispensable on any drilling rig.—G. H. Luck." —Yours very truly,

H. J. Lockhart,
Purchasing Agent.

West Pullman, Ill., July 10, 1916.
SUBJECT: *Crater Compound.*

Mr. H. T. Snell,
Chicago, Illinois.

Dear Sir:—About two weeks ago a man came into this yard to purchase some gasoline for an old fashioned friction drive automobile. After his tank was filled with gas he was unable to pull out of the yard on account of slippage due to worn discs. He had no adjustments to take up this slippage, and after working on the machine for about twenty minutes he asked me to tow him home. I told him in a nice way that his friends would not like to see him at the end of a rope, and asked his permission to apply a little Crater Compound, trusting that this would do the trick. After a little explanation and urging I was permitted to apply the Crater. I jacked up the rear wheels and allowed the Crater to be evenly distributed by running the motor with discs engaged. When I thought that it was o. k. I let the wheels down and told him that he was now ready to climb Pike's Peak. He said that he had heard a lot of that "bunk" before but if it was all right he would buy some. He got into his seat, put the car in speed, made a jump, and was gone. By chance I met him on the street the other day and asked him how the "bunk" worked. He said it was doing fine and that he had not had any more slipping. He asked me why we put stuff on the market that would not wear off, as the little Crater that I had put on was still there and did not look as if it was going to leave very soon. He formerly used from two to five pounds of rosin a week, whereas the tablespoonful of Crater that I used was still there.

Yours very truly,

H. N. Pletz.

"CRATER JONES"

MANY of our friends have noticed that we have a new and very active member of our organization by the name of "Crater Jones." This personage was created because we needed one personality through whom we might express the various terse reports that are sent in every day by our many operators, in which they use the most enthusiastic terms concerning the fine success they are having with Texaco Crater Compound for various classes of work.

"Crater Jones" is really a composite of all of our technical salesmen and engineers. His sayings are taken directly from reports of trials and demonstrations which have resulted in immediate and sometimes very large orders, not only for Crater Compound but for our entire line, as "Crater Jones" being naturally a remarkably high class technical salesman, never neglects to follow up the good work of Crater Compound by installing our oils throughout the plant.

We have received a considerable number of letters, some of them containing orders and checks, addressed to "Crater Jones" by interested parties who desire to be helped out of their lubricating difficulties.

W. F. PARISH.